IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In Re Application of:

Jerrell P. Hein

Application No: 09/693,652

Filed: October 21, 2000

For: LOW VOLTAGE SENSING AND CONTROL OF BATTERY REFERENCED TRANSISTORS IN SUBSCRIBER LOOP APPLICATIONS

Examiner: Quoc D. Tran

Art Unit: 2614

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Supplemental Appeal Brief Under 37 C.F.R. § 41.37

Appellant respectfully submits this supplemental appeal brief in response to the Office Communication dated January 24, 2007 that mandated submission of this supplemental appeal brief within one month to sustain the appeal.

The original appeal brief was submitted in support of an appeal from the Examiner's Final Office Action dated June 3, 2004 that finally rejected claims 1-16 and 19-20. The Appeal Brief was accompanied by an Amendment After Final canceling claims 17-18. On January 24, 2007 in response to a November 8, 2006 communication from the Board, the Examiner entered the Amendment After Final that appellant had been submitted nearly two years earlier (March 8, 2005).

The claims appendix has been amended to reflect the now-entered Amendment After Final. Appellant respectfully requests consideration of this Appeal by the Board of Patent Appeals and Interferences for allowance of the above-referenced application.

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I. REAL PARTY IN INTEREST

The above-identified application for patent is assigned to Silicon Laboratories, Inc., the real party in interest. Silicon Laboratories, Inc. is a Delaware corporation having a principal place of business at 400 W. Cesar Chavez, Austin, Texas 78701.

II. RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any other related appeals or interferences that may directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-20 are pending. Claims 1-6 and 19-20 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,323,461 of Rosenbaum ("Rosenbaum"). Claims 7-16 were rejected under 35 U.S.C. § 103 as being unpatentable over Rosenbaum in view of U.S. Patent No. 4,473,719 of Embree, et al. ("Embree"). Claims 17-18 were indicated as being allowable, however, if the Examiner enters the accompanying Amendment After Final, claims 17-18 will be canceled. Claims 1-16, and 19-20 are the subject of this Brief.

IV. STATUS OF AMENDMENTS

The Claims Appendix of this Supplemental Appeal Brief reflects the entry of the Amendment After Final submitted with the original Appeal Brief. The Amendment After Final canceled claims 17-18. No other amendments have been submitted in response to the Final Office Action dated June 3, 2004.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Overview

A subscriber line connects subscriber equipment such as a telephone to a central office. A subscriber line interface circuit (SLIC) provides the interface between the subscriber line and the public switched telephone network. The SLIC is responsible for supporting the BORSCHT functions including Battery Feed ("B"). Various methods and apparatus for controlling the subscriber line battery feed are disclosed.

B. Summary of Claim 1

Claim 1 is directed to a method for controlling a subscriber line. Subscriber loop pull-down circuitry (Fig. 4: Q5, Q6) is provided to decrease at least one of a tip and a ring line current (Fig. 4: I_{TIP}, I_{RING}) in response to a pull-down control signal (Figs. 4, 6: I2, I4). Control circuitry (Figs. 2, 4: signal processor 210; see greater detail in signal processor 610 of Fig. 6) is provided to vary the pull-down control signal in response to a sensed current (Fig. 4: IS3-IS1, IS3-IS2) that corresponds to one of a tip or a ring pull-down current. The pull-down circuitry operates in a first domain while the control circuitry operates in a second voltage domain. The first and second voltage domains are distinct. (Specification, p. 10, lines 16- p. 11, line 14; pg. 12, line 1- pg. 14, line 21; pg. 16, lines 3-21; Figs. 4-6)

C. Summary of Claim 6

Claim 6 is directed to an apparatus for controlling a subscriber line. A SLIC includes pull-down circuitry (Fig. 4: Q5, Q6) to vary the current of a selected one of the tip and ring line (Fig. 4: 480, 490) in response to a pull-down control signal (Figs. 4, 6: I2, I4). The pull-down circuitry operates in a first voltage domain. Control circuitry (Figs. 2, 4: signal processor 210; Fig. 6: signal processor 610) provides the pull-down control signal. The control circuitry operates in a second voltage domain distinct from the first voltage domain. A control isolation stage (Fig. 4: Q1-Q4) provides the pull-down control signal from the

control circuitry to the pull-down circuitry. A feedback isolation stage (Fig. 4: RS1, RS2, RS3) provides signals representing a sensed pull-down current to the control circuitry (the pull-down currents I_{EQ5} and I_{EQ6} are computed from IS1, IS2, IS3). The control circuitry provides the pull-down control signal for the selected line in response to the sensed pull-down current. (Specification, p. 10, lines 16- p. 11, line 14; p. 13, line 13- p. 14, line 21; Figs. 4-6)

D. Summary of Claim 19

A SLIC includes a linefeed driver (410) that varies a selected one of the tip (I_{TIP}) and the ring (I_{RING}) current of a subscriber loop in response to pull-up (I1, I3) and pull-down (I2, I4) control signals. The SLIC includes a signal processor (210) that senses a pull-down current (I_{EQ5}, I_{EQ6}) of the selected tip or ring line into a battery feed node (V_{BAT}). The signal processor varies the pull-down control signal in response to the sensed pull-down current. The linefeed driver does not reside within the same integrated circuit as the signal processor. (Specification, p. 10, lines 16- p. 11, line 14; p. 13, line 13- p. 14, line 21; Figs. 4-6)

VI. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL

The rejection of claims 1-6 and 19-20 under 35 U.S.C. § 102 as being anticipated by Rosenbaum.

The rejection of claims 7-16 under 35 U.S.C. § 103 in view of Rosenbaum and Embree.

VII. ARGUMENT

A. Rejection of claims 1-6 and 19-20 under 35 U.S.C. § 102

1. Statement of Law

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in

as complete detail as is contained in the ... claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

2. Claims 1-16, 19-20 are not anticipated by Rosenbaum

a. Rosenbaum fails to teach pull-down circuitry and control circuitry operating in distinct voltage domains

Claims 1-6, and 19-20 were rejected as being anticipated by Rosenbaum. Appellant respectfully submits claims 1-6 and 19-20 are not anticipated. In particular, *Rosenbaum does not teach or suggest pull-down circuitry operating in a first voltage domain, and control circuitry operating in a second voltage domain, wherein the first and second voltage domains are substantially distinct.*

The Examiner has stated in part

> Rosenbaum teaches a method comprising providing subscriber loop pull-down circuitry (10-11) operating in a *first voltage domain (a plurality of voltage levels associated with the on-hook state, tables 1-2)*, wherein the subscriber loop pull-down circuit decreases at least one of a tip and a ring line current (approx. < 13 ma) in response to a corresponding pull-down control signal (control signals 17-18); and providing control circuitry operating in a *second voltage domain (a plurality of voltage levels associated with the off-hook state, tables 1-2) wherein the first and second voltage domains are substantially distinct (off-hook>13ma, on-hook current<13mA; col. 5, ln. 29-47)*, wherein the control circuitry (control circuit 15; col. 2, ln. 5-68) varies the pull-down control signal in response to a sensed current (sensing circuit 12) corresponding to an associated one of a tip-pull down current and a ring pull-down current (col. 5, ln 22 to col. 6, ln. 68; col. 8, ln. 39-65).

(06/03/2004 Final Office Action, p. 2)(*emphasis added*)

Rosenbaum's control circuitry controls the switching circuit to supply a battery voltage during an on-hook state of the subscriber line. The control circuitry controls the switching circuit to supply a controlled output voltage of a voltage generator in an off-hook state of the subscriber line. Tables 1-2 of Rosenbaum disclose the positioning of the switches within Rosenbaum's switch circuitry for different applications. Rosenbaum uses a current threshold of 13 ma to determine when the subscriber equipment is on-hook or off-hook (Rosenbaum, Fig. 5).

Although Rosenbaum uses a *current threshold* of 13 mA to differentiate between the on-hook and off-hook states, appellant respectfully submits that this current threshold used to define subscriber equipment states is irrelevant to the claimed *voltage* domains.

The Examiner has also stated: "Furthermore, V=IR. Therefore, there is always a relationship between V and I." (06/03/2004 Final Office Action, p. 6) Appellant believes that the Examiner is alleging that distinct current domains is equivalent to distinct voltage domains due to the relationship between voltage and current. The fallacy of this argument is the assumption that "R" is a constant. The Examiner has not shown that R is constant between the on-hook and off-hook states.

Even more important, these distinct current domains are only used to define whether the subscriber equipment is on-hook or off-hook. If the Examiner is alleging that the subscriber line current defines the "current domain" of the devices, appellant submits that Rosenbaum's line driver 10 operates during *both* the on-hook and off-hook states. Similarly, control circuitry 15 works during *both* the on-hook and off-hook states (i.e., *both elements operate across both of these domains*). There is no teaching or suggestion that Rosenbaum's "switching circuit 10" or "control circuit 15" operate either in distinct current domains or in distinct voltage domains from each other. Compare with appellant's disclosure at page 11, lines 7-14 referring to approximately 0-5 volts domain for the signal processor (control circuitry) and approximately $-V_{BAT}$ to 0 domain for the linefeed driver (pull-down circuitry). There is no overlap due to the transistor junctions between signal ground (i.e., 0) and the remainder of the pull-down circuitry.

Appellant respectfully submits that Rosenbaum does not teach or suggest providing a subscriber loop pull-down circuitry operating in a first voltage domain; and providing control circuitry operating in a second voltage domain, wherein the first and second voltage domains are substantially distinct.

In contrast, claims 1 and 6 include the language:

1. A method comprising the steps of:

a) *providing subscriber loop pull-down circuitry operating in a first voltage domain*, wherein the subscriber loop pull-down circuitry decreases at least one of a tip and a ring line current in response to a corresponding pull-down control signal; and

b) *providing control circuitry operating in a second voltage domain wherein the first and second voltage domains are substantially distinct*, wherein the control circuitry varies the pull-down control signal in response to a sensed current corresponding to an associated one of a tip pull-down current and a ring pull-down current.

(Claim 1)(*emphasis added*)

6. A subscriber line interface circuit apparatus, comprising:

pull-down circuitry operating in a first voltage domain, wherein the pull-down circuitry varies a current of a selected one of a tip and a ring line in response to a pull-down control signal;

control circuitry providing the pull-down control signal, the control circuitry operating in a second voltage domain substantially distinct from the first voltage domain;

a control isolation stage coupled to provide the pull-down control signal from the control circuitry to the pull-down circuitry; and

a feedback isolation stage providing feedback signals from the pull-down circuitry to the control circuitry, wherein the feedback signals represent a sensed pull-down current associated with the selected line , wherein the control circuitry provides the pull-down control signal for the selected line in response to the sensed pull-down current.

(Claim 6)(*emphasis added*)

Thus appellant submits claims 1 and 6 are not anticipated by the cited reference.

Given that claims 2-5 depend from claim 1 and claims 7-16 depend from claim 6, appellant submits that claims 2-5 and 7-16 are likewise not anticipated by Rosenbaum.

Appellant submits that the § 102 rejections of claims 1-16 have been overcome.

b. Rosenbaum fails to teach or disclose a linefeed driver that does not reside within a same integrated circuit as the signal processor

With respect to claim 19, the Examiner has stated:

Regarding the Rosenbaum reference, applicant further states 'Rosenbaum is silent on the issue of integrated circuits.' In contrast to applicant's

> assertions, col. 7, ln. 63 to col. 8, ln. 12 imply that the control circuit 15 is a processor in the form of integrated circuit (e.g., one package contains a digital-to-analog converter and digital control circuit or state machine)

(06/03/2004 Final Office Action)

The Examiner has analogized Rosenbaum's control circuit 15 to appellant's signal processor and Rosenbaum's driver circuit 10 to appellant's linefeed driver. Appellant re-iterates that Rosenbaum is silent on the issue of integrated circuits, whether any of the components including control circuit 15 are integrated circuits, or whether the driver circuit 10 would be incorporated into the same integrated circuit as control circuit 15.

A careful review of the portion of Rosenbaum cited by the Examiner makes no reference to integrated circuits. The Examiner has equated "digital circuit" with integrated circuit. Appellant notes that "digital circuits" are not synonymous with integrated circuit fabrication. The term "digital" implies a finite number of states or "non-analog", but the term is not explicitly, suggestively, or implicitly indicative of "integrated circuit".

Rosenbaum cannot be an anticipatory reference with respect to limitations that are not taught anywhere in the reference. Appellant thus respectfully submits *Rosenbaum does not teach or suggest a linefeed driver and a signal processor sensing a pull-down current of a selected one of a tip and a ring line into a battery feed node....wherein the linefeed driver does not reside within a same integrated circuit package as the signal processor.*

In contrast, claim 19 includes the language:

> 19. A subscriber line interface circuit apparatus comprising:
> *a linefeed driver* responsive to pull-up and pull-down control signals to vary at least a selected one of a tip and a ring current of a subscriber loop; and
> *a signal processor sensing a pull-down current of the selected one of the tip and ring lines into a battery feed node,* the signal processor generating pull-down control signals for the selected current in response to the sensed pull-down current, *wherein the linefeed driver does not reside within a same integrated circuit package as the signal processor.*

(Claim 19, as amended)(*emphasis added*)

Appellant thus respectfully submits claim 19 is not anticipated by Rosenbaum. Given that claim 20 depends from claim 19, appellant submits claim 20 is likewise not anticipated by Rosenbaum.

Appellant submits that the rejection under 35 U.S.C. § 102 of claims 19-20 has been overcome.

B. Rejection of claims 7-16 under 35 U.S.C. § 103

1. Statement of Law

In order to sustain a rejection under 35 U.S.C. § 103, three criteria must be met:

> *First*, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *Second*, there must be a reasonable expectation of success. *Finally*, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure

(*In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991)(*emphasis added*)

Appellant respectfully submits that the Examiner has failed to establish even a *prima facie* case of obviousness under 35 U.S.C. § 103.

2. Claims 7-16 patentable by dependency

Claims 7-16 depend from claim 6. Embree does not resolve the deficiencies of Rosenbaum argued above. Given that claim 6 is patentable under 35 U.S.C. § 103 in view of Rosenbaum, appellant respectfully submits claims 7-16 are inherently patentable over Rosenbaum irrespective of any combination with Embree.

VIII. CONCLUSION

Appellant respectfully submits that the stated rejections cannot be maintained in view of the arguments set forth above. Appellant respectfully requests that the Board of Patent Appeals and Interferences direct allowance of the pending claims 1-16 and 19-20.

If there are any issues that can be resolved by telephone conference, the undersigned representative of the appellant may be contacted at **(512) 858-9910.**

Respectfully submitted,

Date: February 21, 2007

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CLAIMS APPENDIX

1. (ORIGINAL) A method comprising the steps of:

a) providing subscriber loop pull-down circuitry operating in a first voltage domain, wherein the subscriber loop pull-down circuitry decreases at least one of a tip and a ring line current in response to a corresponding pull-down control signal; and

b) providing control circuitry operating in a second voltage domain wherein the first and second voltage domains are substantially distinct, wherein the control circuitry varies the pull-down control signal in response to a sensed current corresponding to an associated one of a tip pull-down current and a ring pull-down current.

2. (ORIGINAL) The method of claim 1 further comprising the steps of:

c) providing pull-up circuitry, wherein the pull-up circuitry increases the at least one of the tip and ring currents in response to a corresponding pull-up control signal provided by the control circuitry.

3. (ORIGINAL) The method of claim 2 wherein for each of the tip and ring lines, the pull-up and pull-down control signals are mutually exclusive such that the control circuitry does not provide a pull-up and a pull-down control signal for a selected line substantially simultaneously.

4. (ORIGINAL) The method of claim 1 further comprising the step of

c) providing a feedback isolation stage, wherein the feedback isolation stage converts voltages sensed at each end of a tip sense impedance and a ring sense impedance into first and second currents, wherein the sensed current for a selected one of the tip and ring lines represents a difference between the first and second currents for the corresponding selected one of the

tip and ring sense impedances, wherein a difference between the first and second currents for each of the tip and ring lines is calculated in the second voltage domain.

5. (ORIGINAL) The method of claim 1 further comprising the step of:

c) providing a control isolation stage, wherein the control isolation stage provides the pull-down control signals from the control circuitry operating in the second voltage domain to the pull-down circuitry operating in the first voltage domain.

6. (ORIGINAL) A subscriber line interface circuit apparatus, comprising:

pull-down circuitry operating in a first voltage domain, wherein the pull-down circuitry varies a current of a selected one of a tip and a ring line in response to a pull-down control signal;

control circuitry providing the pull-down control signal, the control circuitry operating in a second voltage domain substantially distinct from the first voltage domain;

a control isolation stage coupled to provide the pull-down control signal from the control circuitry to the pull-down circuitry; and

a feedback isolation stage providing feedback signals from the pull-down circuitry to the control circuitry, wherein the feedback signals represent a sensed pull-down current associated with the selected line , wherein the control circuitry provides the pull-down control signal for the selected line in response to the sensed pull-down current.

7. (ORIGINAL) The apparatus of claim 6 wherein the pull-down circuitry further comprises:

a first pull-down transistor having a first terminal coupled to the selected line of the subscriber line and a second terminal coupled to a battery feed node

through a first sense impedance, wherein a first sense impedance current is the sensed pull-down current.

8. (ORIGINAL) The apparatus of claim 7 wherein the sense impedance comprises a resistor.

9. (ORIGINAL) The apparatus of claim 8 wherein the sense impedance further comprises a capacitor.

10. (ORIGINAL) The apparatus of claim 7 wherein the sense impedance consists of passive components.

11. (ORIGINAL) The apparatus of claim 6 wherein the feedback isolation stage consists of passive components.

12. (ORIGINAL) The apparatus of claim 11 wherein the feedback isolation stage comprises resistors.

13. (ORIGINAL) The apparatus of claim 6 wherein the control isolation stage comprises active components.

14. (ORIGINAL) The apparatus of claim 13 wherein the active components are coupled in a common base configuration.

15. (ORIGINAL) The apparatus of claim 13 wherein the active components comprise bipolar junction transistors coupled in common base configuration.

16. (ORIGINAL) The apparatus of claim 13 wherein the active components comprise field effect transistors coupled in common gate configuration.

17. (CANCELED)

18. (CANCELED)

19. (ORIGINAL) A subscriber line interface circuit apparatus comprising:

a linefeed driver responsive to pull-up and pull-down control signals to vary at least a selected one of a tip and a ring current of a subscriber loop; and

a signal processor sensing a pull-down current of the selected one of the tip and ring lines into a battery feed node, the signal processor generating pull-down control signals for the selected current in response to the sensed pull-down current, wherein the linefeed driver does not reside within a same integrated circuit package as the signal processor.

20. (ORIGINAL) The apparatus of claim 19 wherein the signal processor calculates the selected current without directly sensing either the tip or ring lines of the subscriber loop.

EVIDENCE APPENDIX

This Section Not Applicable

RELATED PROCEEDINGS APPENDIX

This Section Not Applicable